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# "Mao's last revolution": a dictator's loyalty–competence tradeoff

**Ying Bai**[1] · **Titi Zhou**[2]

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**Abstract**
Although competent (vs mediocre) subordinates, while better contributors to dictator success, are also more prone to treason, it remains unclear empirically how (and even whether) dictators address this loyalty–competence tradeoff. To throw light on this issue, we use a biographical dataset of Chinese Communist Party Central Committee (CC) members from 1945 to 1982 to investigate the tradeoff faced by Mao Zedong in selecting his senior officials. Our results suggest that during the Cultural Revolution (1966–1976), the foundation and consolidation of the new regime lowered the payoff from subordinate competence, leading to the purging of competent CC members and their replacement by mediocre substitutes. Additional analyses of the competing mechanisms proposed by different theoretical models indicate further that capable young subordinates are more likely to be purged, possibly because they have more outside options (e.g., future hiring by the dictator's successor) and, hence, expend less effort on loyalty.

**Keywords** Loyalty–competence tradeoff · Political selection · Cultural Revolution · China

**JEL Classification** D73 · P26 · C72

✉ Ying Bai
ybai@cuhk.edu.hk

Titi Zhou
zhoutiti.bj@gmail.com

[1] Department of Economics, The Chinese University of Hong Kong, Shatin, Hong Kong

[2] Department of Asian and Policy Studies, The Education University of Hong Kong, Tai Po, Hong Kong

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## 1 Introduction

Faced with the competence–loyalty tradeoff inherent in a dictatorship (Egorov and Sonin 2011; Glazer 2002; Wagner 2010; Zakharov 2016), dictators frequently favor loyalty over competence when appointing subordinates, even though more competent subordinates could better assist them in effectuating political repression and/or creating economic rents.[1] While various theoretical paradigms developed to model dictator decision-making processes explain the tradeoff in terms of different mechanisms, one leading approach (exemplified by Egorov and Sonin 2011) focuses on subordinate competence as a double-edged sword.[2] That is, although competent subordinates can better identify potential plotters and thereby help the dictator maintain power, they also are better equipped to sense the odds of winning a potential coup, allowing them to participate in the dictatorial regime with lower betrayal costs. As a result, when choosing subordinates, the dictator must sacrifice competence in favor of more loyal mediocrities. An alternative model, pioneered by Zakharov (2016), concentrates on the greater number of outside options available to more capable subordinates (e.g., recruitment by the dictator's successor), which reduces the amount of effort they are willing to expend on loyalty. A dictator thus tends to hire incompetent subordinates, especially when the payoff from competence is smaller. Yet even though several large-*N* empirical studies have addressed the role of the tradeoff in political selection (Reuter and Buckley 2017; Reuter and Robertson 2012; Shih et al. 2012; Xi 2018), little systematic empirical testing of these theories has been undertaken.[3]

As the two approaches generate both common and different predictions, this study attempts to test them to enhance our understanding of the tradeoff mechanisms. For that purpose, we refer to the mass replacement during China's Cultural Revolution (1966–1976) of around 200 senior officials, previously appointed to the Central Committee (CC) by Mao Zedong, the Chinese Communist Party's (CCP) paramount leader, the mandate of which was to fight the Kuomintang (KMT), establish the People's Republic of China (PRC) and revive the war-torn economy. Once the appointees had accomplished those tasks, they were replaced by a new group of CC members. Both models predict that when Mao was competing to establish a new regime, he willingly would recruit competent supporters, but having defeated his rivals and consolidated the new regime, he was likely to replace them with more mediocre subordinates.

However, owing to the difference in mechanisms, the two models generate different predictions about the type of competent subordinates most likely to be replaced. From the first perspective, subordinate competence is a double-edged sword (Egorov and Sonin 2011; Glazer 2002): as consolidation of the new regime increased the value of power, the cost of subordinate betrayal would rise, prompting Mao to replace competent officials with mediocre ones. If that mechanism is valid, we expect that given the same level of competence, members of the targeted purged faction would be subject to more

[1] The tradeoff also is regarded as a critical issue in studying bureaucracy in democracies (Edwards 2001; Lewis 2008) and corporate governance (Burkart et al. 2003; Friebel and Raith 2004; Glazer 2002; Prendergast 1993; Prendergast and Topel 1996).

[2] Several theoretical models advance similar arguments based on different dynamics. For instance, Glazer (2002) defines subordinate competence as a double-edged sword in light of the fact that although competent subordinates can produce benefits for the dictator, they simultaneously may acquire too much political power by rent seeking inside the organization.

[3] Zakharov (2016) summarizes the large-*N* empirical studies. Besides such systematic evidence studies, anecdotes also abound, as reviewed by Egorov and Sonin (2011) and Bueno de Mesquita and Smith (2011). Moreover, some empirical works address the tradeoffs in the context of public agencies (Wagner 2011).

purging because the cost of removing them would have declined. From the second perspective of outside options (Zakharov 2016), because the value of competence is higher during civil conflict, we expect more frequent hiring of competent subordinates during the pre-Cultural Revolution (CR) period followed by their replacement after power consolidation with incompetents who have fewer outside options and a lesser competence. That logic implies the auxiliary prediction that younger competent members are more likely to be purged than their older counterparts.

We construct a detailed biographical dataset that allows us not only to test the replacement of competents with incompetents, but also to differentiate the competing predictions by interacting CC members' personal characteristics with competence measures. We start by defining two proxies for CC member competencies: education level (Besley et al. 2011; Besley and Reynal-Querol 2011; Card 1999) and, for military CC members, officer ranks conferred about a decade prior to the CR. We use schooling years to measure education level and convert it further into percentile ranks for each birth cohort (taken from China's 1982 census data), because China's rising education levels over time mean that the completion of the same schooling has different implications for competence among different birth cohorts. We base our second measure of competence on the military ranks conferred around 1955 to recognize the officers' historic battle achievements. After constructing a candidate pool for the selection of the officers, including generals and marshals whose ranks were awarded in the mid-1950s, we analogously convert the ranks into percentiles.

We first test whether the selection of competent candidates to the Central Committee became less likely during the CR period than before it. Our results confirm that the average competence of CC members declined sharply as the CR progressed, with the average educational level of members declining from a percentile rank of 93.83 for the Eighth (pre-CR) National Party Congress (NPC) of 1958, to 89.95 for the Ninth (CR era) NPC of 1969. An even more pronounced decline occurred concurrently in military rank percentile (from 72.09 to 63). Because the members of the different CCs also vary in other ways, such as demographics, occupational backgrounds, and Party seniority, we use individual observations and a conditional logit model (CLM) to estimate the change in the effect of competence on the likelihood of selection for committee membership when controlling for such confounding factors. Consistent with the loyalty–competence tradeoff hypothesis, the results show a significant decline in competence coincident with the CR, which remains robust even after we control for various demographic factors and CCP seniority.

Although the evidence supports the interpretation of an anti-competence policy during the CR as a loyalty–competence tradeoff, our China-specific context allows for two competing explanatory hypotheses: ideological vision and revolutionary pressure. That is, although Mao's shifting ideological vision—including a growing hostility to higher education as a key driver of the CR—can explain the fall in CC member competence and reduced likelihood of selecting more competent (i.e., more educated) civilians, it cannot predict the declining rank of the committee's military members, given that the CR did not disparage military skills. Another potential explanation for lesser CC member competence is the power-struggle hypothesis, under which Mao's purging of senior officials also would coincide with the purging of members of their political factions. That hypothesis, however, holds only if the CC members in the purged factions were more likely to be competent. In fact, when we test the power-struggle hypothesis by entering factional ties to key political figures into the regression, we find that although a factional tie to Liu Shaoqi, the key political target during the CR, has a positive effect on CC member replacement, the inclusion of factional ties overall results in only trivial changes to our baseline results.

We then consider the competing predictions and find strong support for the outside option mechanism: not only does the interaction between birth year and education have a significantly positive effect on the probability of being purged, but the younger educated CC members belonging to the Liu faction indeed were more likely to be removed. The possible reason might be that younger competents, especially those in the Maoist rival faction, had more outside options and were more likely to be recruited by Mao's successor and, hence, may have expended less effort on loyalty. In contrast, the evidence for the double-edge sword mechanism is weak. The model predicts that competents in the targeted faction are more likely to be purged. However, the results show that although the interaction between the Liu factional tie and education is positively related to the probability of being purged during the CR, the relation is not significant.

Our findings thus make a useful contribution to the literature on the principal-agent relation between leaders and their subordinates in authoritarian regimes (Acemoglu et al. 2008; Boix and Svolik 2013; Egorov and Sonin 2011; Myerson 2008). That is, in addition to providing empirical evidence that the loyalty–competence tradeoff may induce dictators to replace competent subordinates with mediocre individuals, this article can help unlock the black box of Mao's decision-making process, perhaps even allowing its extrapolation to increase understanding of the behavior of his present-day counterparts. Our analysis also sheds light on the causes of political oppression in dictatorships and may shed light on the purges undertaken in other countries, such as the Soviet Union in the 1930s, Nazi Germany in 1934, Cambodia in the 1970s and, most recently, North Korea.

Our analysis also supplies evidence on why the most personalized dictatorships tend to exhibit strikingly poor governance (see, e.g., Bueno de Mesquita et al. 2003), a dynamic whose genesis remains elusive. In particular, although recent research underscores the importance of national leaders in relation to economic development (Besley et al. 2011; Jones and Olken 2005), the channels through which they exercise their influence remain unclear. Our findings imply the novel perspective that a dictator's sway over the selection of senior officials also may affect the quality of national governance and economic performance. Yet extant research on government official turnover and its implications for economic growth in China focuses exclusively on the post-Mao period in which the CCP adopted an age-based retirement policy for senior officials and China liberalized its economic system (Jia et al. 2015; Landry 2008; Li and Zhou 2005; Shih et al. 2012). Hence, to the best of our knowledge, ours is the first empirical study to examine the selection of senior officials under Mao's dictatorial regime and planned economy.

The remainder of the paper is organized as follows. Section 2 introduces the historical background, after which Sect. 3 describes our data, defines the variables and provides descriptive evidence. Section 4 then explains our use of individual observations to test the determinants of CC selection probabilities. Section 5 tests the competing predictions of previously discussed mechanisms. Section 6 concludes the study.

## 2 Historical background

Before outlining the relevant patterns of power elite turnover involved in the replacement of CC members between 1945 and 1982, we first need to provide a brief history of the 1966–1976 movement commonly referred to as the Cultural Revolution (CR).

### 2.1 Cultural revolution

The Great Proletarian Cultural Revolution (1966–1976) was a decade of chaos and destruction that resulted in the dismantling of the party-state bureaucracy, and turmoil from below that devastated both the economy social networks, eventually causing the deaths and suffering of millions of people.[4] It can be divided into two periods, with the CCP's Ninth NPC (April 1969) as its cut-off event.

The first period is perceived as the truly manic stage of the CR, during which "the political crisis induced by Mao was the deepest, the chaos the greatest, and the human costs the highest" (Harding 1997, p. 150). It evolved in four phases. The first began with the CCP Politburo's "May 16 Notification" in 1966. That notification formally set out Mao's CR agenda and summarized his ideological justification for the movement, namely, that some "representatives of the bourgeoisie who have sneaked into the party, the government, the army, and various spheres of culture" were "counter-revolutionary revisionists" bent on restoring capitalism (MacFarquhar and Schoenhals 2006, p. 47) and should be removed through violent class struggle. The first to respond to Mao's call were college and high-school students, who soon formed Red Guard organizations and engaged in increasingly violent assaults on almost any persons in authority and on the entire party system. Meanwhile, in a drastic reshuffle of the party's leadership, key figures from the pre-CR government such as Liu Shaoqi and Deng Xiaoping, were excluded from party affairs at the Eighth CC's Eleventh Plenum (August 1966), even though their names remained on the roster of the Politburo Standing Committee, while Lin Biao was elevated to the party's number two figure and Liu's rank was lowered from second to eighth.

The second phase began with the CC's "Decision Concerning the Great Proletarian Cultural Revolution" on August 8, 1966, which elevated the student movement to a nationwide mass campaign to challenge authority and restructure society. From then until the end of 1966, Red Guards rampaged through cities to destroy the "four olds": old ideas, old culture, old customs and old habits. The students soon were joined by other groups of workers and peasants. Many authority figures during the process, such as school teachers, intellectuals and Communist Party members, were imprisoned, tortured and executed. Not only the educational system, but also the whole party system was practically dismantled.

Subsequently, starting from January 1967, the first CR period entered its third phase as the Red Guards organized to take over many parts of the social establishment in their so-called "Seizure of Power". The movement was authorized by Mao to replace the discredited authorities by setting up new Revolutionary Committees, including members from mass organizations, surviving cadres and the People's Liberation Army (PLA). However, owing to the open and armed conflicts between radicals and conservatives within the Red Guards, Mao failed to restore order and finally was forced to call in the PLA to suppress the mass crusade.

In the fourth phase, from the summer of 1968 through April 1969, Mao continued trying to rebuild the system as the Party's institutional framework, established at the Seventh NPC in 1945, which had almost been entirely disassembled. Hence, the Ninth NPC was convened in April 1969, when a new CC was selected, but with delegates chosen by the Revolutionary Committees rather than elected by party members as had been happened at the Seventh and Eighth congresses. The PLA thus gained a preeminent role, and the

[4] For more details of these developments, see Harding (1997), MacFarquhar and Schoenhals (2006) and Walder (2015).

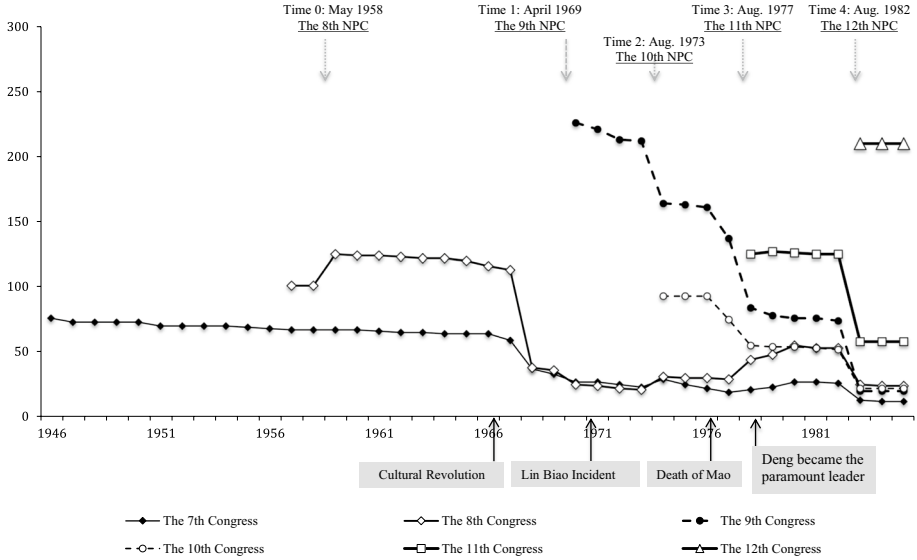


**Fig. 1** The replacement of CC members, January 1, 1946–January 1, 1985

representation of the military in the CC grew dramatically, with military leader Lin Biao elevated to the party's number-two figure and designated as Mao's heir.

Although Mao declared an end to the CR officially in 1969, political instability persisted from then to 1976, in what is now regarded as the second CR period. The CR's true end came on October 10, 1976, when Mao's handpicked successor, Hua Guofeng, arrested the members of the Gang of Four in a virtually bloodless coup.[5] After 1978, a rehabilitated Deng Xiaoping gradually became the new paramount leader and abandoned most of the CR-associated Maoist reforms. In fact, since the Sixth Plenum of the CCP's Eleventh CC on June 27, 1981, the CR has officially been regarded as a negative phenomenon whose legacy was a badly damaged and backward China. Hence, prompted by the pressing socio-economic problems and traumas of political chaos, Mao's successors, led by Deng Xiaoping, decided not only to rebuild the party system, but to reject the command economy while establishing an export-oriented market, which later turned out to be one of the most fundamental bases for the legitimacy of CCP rule.

## 2.2 Replacement of CC members, 1945–1982

The members of China's CC are a well-defined group of power elites, all of whom hold key positions in the party, military, various branches of government and mass organizations. Although they are formally elected by delegates at the NPC, in practice the process is top-down rather than bottom-up (Li 2008). Party leaders control CC member selection tightly

[5] The Gang of Four (*Siren Bang* in Chinese) was a political faction composed of Jiang Qing (Mao's wife), Zhang Chunqiao, Yao Wenyuan and Wang Hongwen, who came to prominence during the CR. Their radical ideas, however, clashed with those of influential elders. So with the support of Ye Jianying, they were arrested, charged with a series of treasonous crimes, and imprisoned.

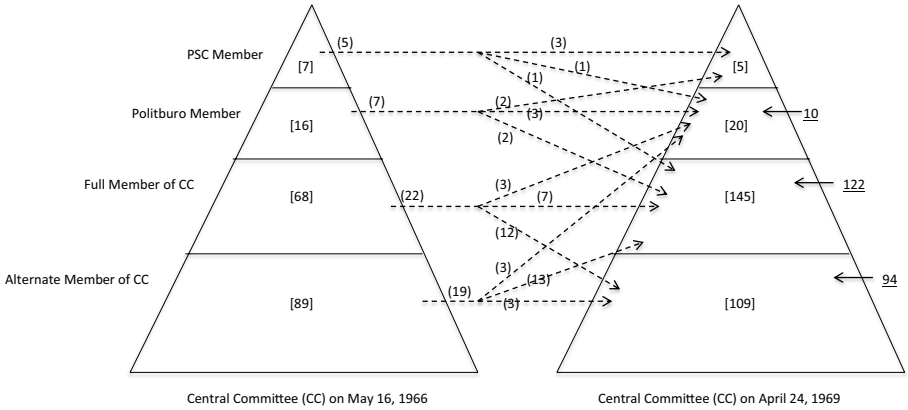


**Fig. 2** The replacement of CC members between May 1966 and April 1969. *Notes*: The numbers of PSC members, Politburo members, and full and alternate members of the CC are reported in the brackets; the numbers of members that survived the purge are reported in parenthesis, and the numbers of members newly selected into the CC are underlined

through a system of personnel management (*nomenklatura*) that is structurally hierarchical and procedurally bureaucratic (Harasymiw 1969; Kung and Chen 2011).

Given the party's reliance on the CC to rule the country, the mass purge of CC members was the most intriguing event during the CR. It came in the wake of the violence and destruction created by Red Guards during the first CR period (1966–1969), at the end of which only 53 of the 180 members previously in place were reelected to the CC at the Ninth NPC. To illustrate this process more fully, we divide all members from the 1945–1982 period into six groups based on the NPC at which they first entered the CC, and then track the changes in their membership over time.[6] As Fig. 1 shows, two groups of members served on the CC before the CR: those who first entered the CC at the Seventh and Eight Congresses. Although those members had proven ability given their experience in the two KMT-CCP civil wars (the first during 1927–1937; the second during 1946–1949), the second Sino-Japanese war (1937–1945) and the economic recovery in the early period of the PRC, the majority of them were purged heavily during the CR. Specifically, of the 64 members appointed during the Seventh NPC who remained in office in 1965, 69% were purged during 1966–1969, while of the 116 members appointed during the Eighth NPC, 9% were removed during the same period.[7]

The replacement involved all ranks of CC members; for example, for the Politburo Standing Committee (PSC), only three of seven members remained at the pinnacle of political power (see Fig. 2). Zhu De was demoted to Politburo member, Chen Yun elevated to full member of the CC, Deng Xiaoping was considered a common worker, and Liu Shaoqi was placed under house arrest. Among the next levels of CC membership, Politburo members and full and alternate members, seven of the 16 Politburo members, about 44%, were

[6] "Appendix 1" describes our data-collection process, while "Appendix 2" shows the annual changes in the size of each CC formed during 1945–1982.

[7] Of the 204 CC members at the Seventh and Eighth NPCs, only 24 had exited the CC by 1966, the year of the CR's inception, primarily because of death from natural causes.

reelected to the CC at the Ninth NPC versus only 32% and 21% of full and alternate members, respectively.

After the massive purge from 1966 to 1969, 226 new members joined the CC at the Ninth NPC (Fig. 1); however, by 1973, when the Tenth NPC was convened, 75 Ninth NPC members had left and 113 new members had been recruited. The replacement patterns shifted further after Mao's death to the rehabilitation of some Seventh and Eighth NPC members (pre-CR group) and the removal of the Ninth and Tenth NPC members (CR group). By 1982, when Deng became the paramount leader and dominated CC member selection at the Twelfth NPC, 81 members of the pre-CR group returned to the CC and then played important roles in the period of economic reform (1978 to present). In contrast, the size of the CR group in the CC declined sharply and became much smaller than that of the pre-CR group, despite their younger average age and larger initial size.

## 3 Data and descriptive evidence

In the following subsection, after first detailing the construction of our CC member dataset and describing our main analytical variables (Sect. 3.1), we present two sets of descriptive patterns that motivate our analysis (Sect. 3.2).

### 3.1 Biographical dataset for CC members

Our empirical study is based on a 1945–1982 biographical dataset of CC members collected from the *Dictionary of Past and Present CCP Central Committee Members* (2004), the "Appendix" of which lists the names and tenures of all CC members. That listing not only covers more than 1600 individuals, ranging from the first CC members selected in 1921, to those of the Sixteenth CC formed in late 2002, but also provides a brief biography of each member, including basic demographics, education, and work experience. Although Shih, Shan and Liu (2010) were the first to construct such a dataset, we compiled our observations independently, with more detailed codings of education, military rank, and other variables (see "Appendix 1" for details).

#### 3.1.1 Competence measure 1: education percentile by birth cohort

Our first measure of competence is based on education, which originally is a categorical variable. But because changing national education attainments over time mean that the same educational level in different time periods indicates different competence levels,[8] we use education percentile ranks in the birth cohort, rather than absolute levels, to proxy competence. To do so, we first convert educational levels into years of schooling based on China's education system from 1911 to 1949, with 4 and 6 years equivalent to junior and senior primary school levels, respectively; nine and 12 years equivalent to junior and senior high school levels, respectively; and 14 years or more equivalent to college or above.[9] We then use China's 1982 census data to compute the distribution of school years for the males

[8] "Appendix 3" compares CC members' years of schooling with the national average.

[9] "Appendix 4", Fig. 7a shows the annual changes in the average years of schooling for CC members.

in each 5-year birth cohort and calculate the percentile ranks of each CC member based on their schooling years relative to other people in the same birth cohort.

#### 3.1.2 Competence measure 2: military rank percentile by birth cohort

Whereas the education percentile may not be a good proxy for military officers' competence, their historic battle achievements, even though difficult to code directly, should serve as a sounder measure. Fortunately, around 1955, China conferred military ranks based on battlefield performance from 1927 to that time, which we can use to proxy competence. One possible caveat is that military competence or historic battle achievements might not be the only determinants of military rank, which also could be affected by factional ties and personal characteristics, which we thus control for in the regression analysis (see Sect. 4.3). It is also worth noting that the 1955 awarding of military ranks was the only such event during our study period and that such ranks were abolished in 1965 shortly before the CR. They thus had no direct relation to official positions once the CR began.[10]

According to the Central Military Commission's "Instructions on the Assessment of Military Ranks" (1955), ranks are classified into 19 grades in six categories: marshal, general, field officer, junior officer, noncommissioned officer and enlisted personnel. We focus exclusively on the first two categories because they contain all of the possible ranks awarded to military CC members. The marshal category (coded 5) comprises two grades: Grand Marshal of New China and Marshal of New China. The general category consists of four grades: grand general (4), general (3), lieutenant general (2) and major general (1).[11] First, assuming that all the generals and marshals whose military ranks were awarded in 1955 to be the pool of candidates from which military CC members were chosen, we code the ranks of both the candidates and the selected members.[12] To measure the competence of the selected members, we also calculate their percentile ranks based on their ranks relative to other candidates in the same birth cohort.

### 3.2 Descriptive patterns

When we look at the overall competence distribution of each CC, we see a major change with the initiation of the CR, as illustrated in Fig. 3 using kernel density estimation.[13] In particular, the education percentiles for Eighth CC members, indicated by the solid line in Fig. 3a, largely are skewed above the 90th percentile, indicating a very high competence level before the CR. The percentile distributions for CR-era Ninth and Tenth CC members, however, are much more uniform, indicating an increasingly larger share of members with lesser competence. After the CR ends, the percentile distributions for Eleventh and Twelfth CC members re-concentrate on the right,

[10] In a detailed historical analysis, Ouyang (2008) shows that the 1955 awarding of ranks was based on a very high and strict standard. The awarded performance-based military ranks deliberately were set below the position-based military ranks.

[11] We also include a category for "other military officer", coded 0. "Appendix 4", Fig. 7b shows the annual changes in the average ranks of the military CC members.

[12] These data are taken from the *Directory of the PLA Generals and Marshals* (*Zhongguo renmin jiefangjun jiangshuai minglu,* 1987–1988), published by Xinghuo Liaoyuan Publishing House.

[13] We define the kernel density estimator as $\hat{f}(Q) = \frac{1}{n}\sum_{j=1}^{n}\frac{1}{h}\phi\left(\frac{Q_j - Q}{h}\right)$, where $\phi(\cdot)$ is the standard normal density function.

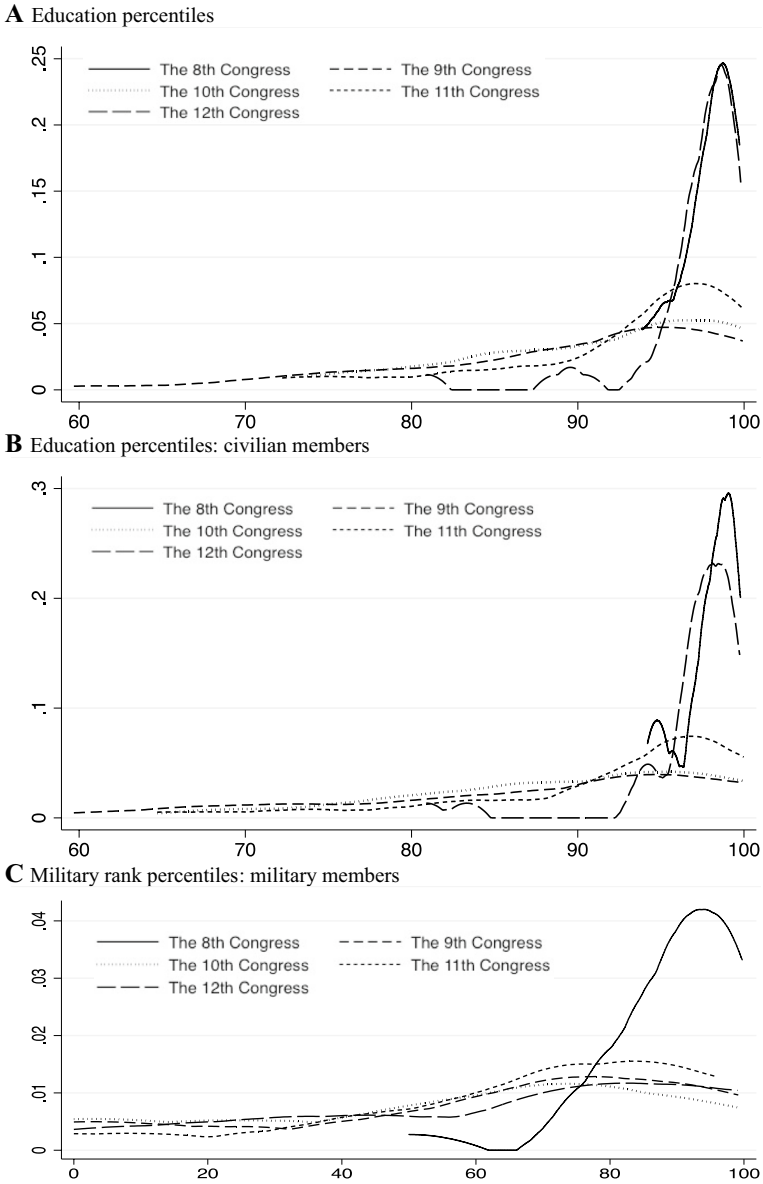


**Fig. 3** Competence distribution by CC

implying an increase in the overall competence level. The distribution for Twelfth CC members, in particular, is similar to that for pre-CR Eighth CC members. Those distributional changes are even more pronounced when we consider civilian CC members only, whose percentiles indicate a remarkable decline in competence from the pre-CR Eighth CC to the first CR-period Ninth CC, followed by a subsequent gradual increase

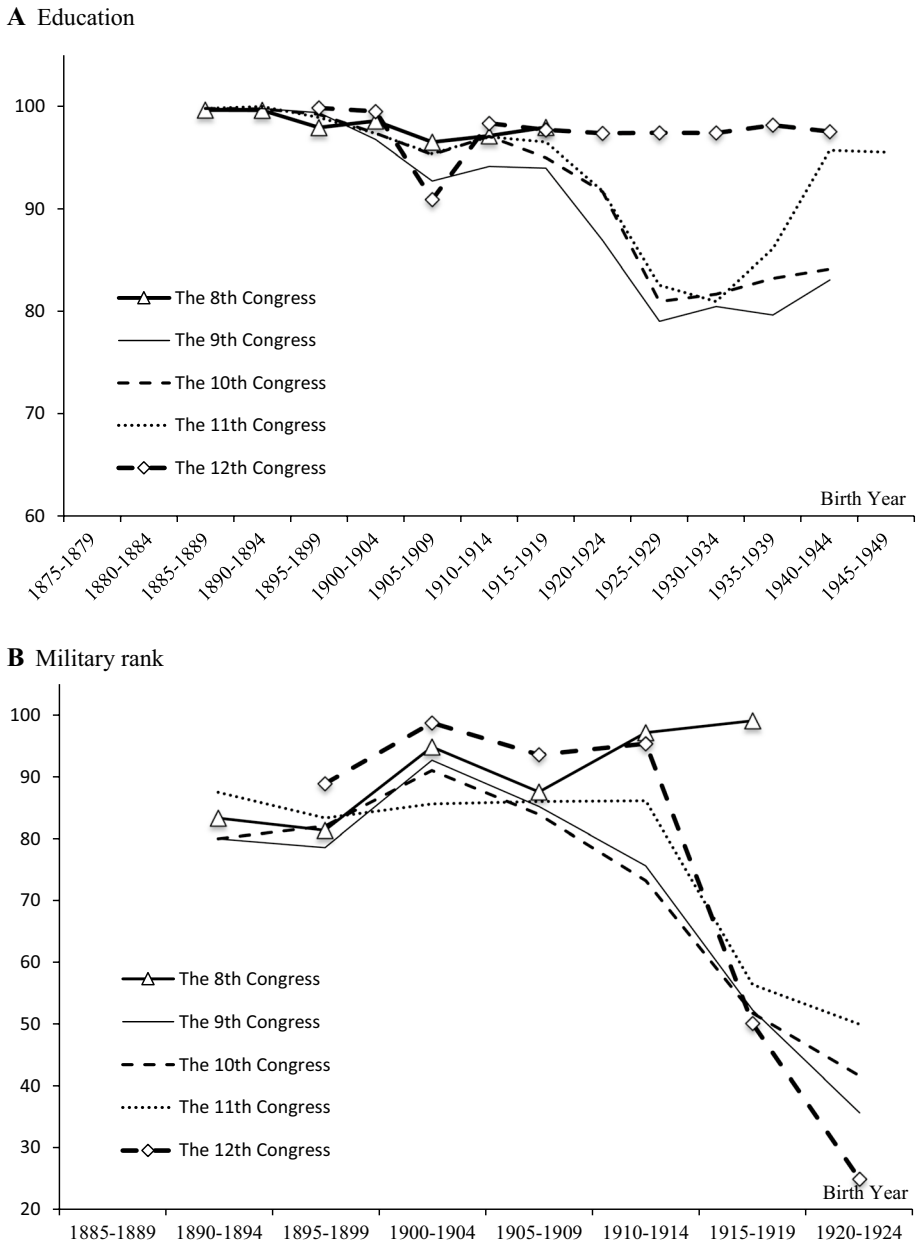


**Fig. 4** Average percentiles of CC members across birth cohorts by CC

(Fig. 3b). The sharp decline in competence between the Eighth and Ninth CC is mirrored in Fig. 3c, which plots the overall distribution of military rank percentiles for each CC.

### 3.2.1 Distribution of competence measures over time

In Fig. 4a, we plot the average education percentiles of CC members in each birth cohort by CC. For the CC members selected at the pre-CR Eighth NPC, the average percentiles generally are in the top ranks (above the 95th), but once the CR begins, the average percentiles of those selected at the Ninth NPC (hereafter, Ninth CC members) decline sharply. For instance, the average percentile of the 1925–1929 cohort of Ninth CC members is only around the 80th, clearly indicating mediocrity. Beginning with Tenth CC members in 1973, however, the average percentiles begin to increase, finally reaching above the 95th percentile for the post-CR Twelfth CC members. Nonetheless, when we repeat the exercises for civilian and military CC members (see "Appendix 5"), we find that the civilian CC members' average education percentiles decline much more than those of the military members. One possible reason is that education might not be a good measure of the military members' competence.

As Fig. 4b shows, a clear decline is evident from the average percentile of military members of the pre-CR Eighth CC—whose 85.3 to 99.1 range implies the presence of the most competent generals—to the significantly lower percentile ranks in the first CR period Ninth CC. From the second CR period onward, however, the average percentiles for the military CC members change little.

### 3.2.2 Birth cohort analysis

In this section, we use birth-year aggregate data to estimate changes in competence level across the CCs. Specifically, we use the average percentile ($Q_{jt}$) of CC members born in year $j$ who served in the $t$th CC as our dependent variable and estimate the changes in CC member competence by regressing it on a set of dummy variables $I_t$ that represents the $t$th CC, whose effect is the focus of our analysis[14]:

$$Q_{jt} = \sum_{t=9}^{12} \tau_t I_t + \alpha_j + \upsilon_{jt}, \tag{1}$$

where $\alpha_j$ represents a birth year-specific effect and $\upsilon_{jt}$ is the error term.

We report the results in Table 1, whose first two specifications (columns 1.1 and 1.2) have the average percentile of CC member education as the dependent variable. In column (1.1), we show that, using a random effects (RE) model, the CC members' average percentile declines significantly by about 5.073 percentile points from the pre-CR Eighth CC to the first CR period Ninth CC. In column (1.2), that change in average percentile remains significant and negative using the fixed effects (FE) model that controls for birth-year specific influences, even though the magnitude declines. Given that education matters more in the quality and performance of civilians, we run the same regressions for the subsample of civilian CC members and find an even larger decline during the first CR period. Specifically, as columns (2.1) and (2.2) show, the average percentile falls by about 6.096 and 4.387 percentile points, according to the RE and FE models, respectively. We also note a significant decline in the average percentile for military CC members during the

[14] "Appendix 5" provides descriptive evidence on the distribution of the average percentiles ($Q_{jt}$) across birth cohorts for each CC for civilian and military members, respectively.

**Table 1** Birth cohort analysis: changes in the average percentile of CC members across CCs

| Dependent variable | Average education percentile | | | | | | Average percentile of military ranks | |
|---|---|---|---|---|---|---|---|---|
| | All CC members | | Civilian members | | Military members | | | |
| | (1.1) | (1.2) | (2.1) | (2.2) | (3.1) | (3.2) | (4.1) | (4.2) |
| | RE | FE | RE | FE | RE | FE | RE | FE |
| Ninth CC (1969) | −5.073*** | −3.882*** | −6.096*** | −4.387*** | −2.385*** | −2.486** | −10.331** | −9.110* |
| | (1.203) | (0.902) | (1.470) | (1.097) | (0.866) | (0.833) | (4.573) | (4.590) |
| Tenth CC (1973) | −3.544*** | −2.214** | −5.261*** | −3.298*** | −0.235 | −0.210 | −9.826** | −8.006 |
| | (1.059) | (0.747) | (1.348) | (0.906) | (0.879) | (0.873) | (4.373) | (4.576) |
| Eleventh CC (1977) | −1.808** | −0.414 | −2.433** | −0.335 | −0.330 | −0.447 | −8.353** | −7.334* |
| | (0.902) | (0.809) | (1.019) | (0.976) | (0.870) | (0.882) | (3.845) | (3.836) |
| Twelfth CC (1982) | 3.064** | 4.751* | 3.771** | 6.444** | 0.005 | −0.163 | −6.293 | −5.234 |
| | (1.513) | (2.186) | (1.619) | (2.659) | (0.753) | (0.768) | (6.363) | (6.089) |
| Constant | 95.094*** | 93.833*** | 94.987*** | 92.862*** | 95.800*** | 97.109*** | 66.328*** | 72.091*** |
| | (1.103) | (0.635) | (1.238) | (0.800) | (1.470) | (0.658) | (10.939) | (3.540) |
| Number of observations | 227 | 227 | 212 | 212 | 144 | 144 | 135 | 135 |
| Number of birth years | 57 | 57 | 57 | 57 | 42 | 42 | 38 | 38 |
| R-squared (within) | 0.30 | 0.31 | 0.34 | 0.35 | 0.13 | 0.13 | 0.12 | 0.12 |

Coefficients are reported with robust standard errors in parentheses clustered by 5-year cohort; *significant at 10%; **significant at 5%; ***significant at 1%

same period, with a 10.331 percentile point decrease in the RE model (column 4.1) and a 9.110 decline in the FE model (column 4.2). These results are thus consistent with the dictator's loyalty–competence tradeoff hypothesis, which posits that the average level of CC member competence fell with the initiation of the CR. To check the robustness of our results, we replace the education percentiles of the CC members with years of schooling as the dependent variable and use military rank as the dependent variable for military CC members. As shown in "Appendix 6", the results are similar: from the pre-CR Eighth CC to the first CR period Ninth CC, years of schooling decline by a significant 0.874 of a year (column 1.2), and the military ranks decline by 0.475 of a unit (column 4.2).

## 4 Estimating the changes in competence's effect on CC member selection

Our descriptive evidence show that CC members' average competence dropped significantly after the launch of the CR, implying that during this period, China's paramount leader Mao tended to select mediocre officials. On the other hand, the members of different CCs also vary on other factors, such as demographics, occupational structure, and Party seniority.[15] It is possible, therefore, that those factors might be correlated with competence level, and that the CC members' declining competence during the first CR period actually may reflect changes in their characteristics. To account for that possibility, we use individual-level data to test whether our findings from the aggregate data still hold. Moreover, we will discuss two alternative explanations for the decrease in competence's effect on CC member selection.

### 4.1 Baseline results

Although lack of information on the candidate pool for CC member selection prevents us from estimating the effects of individual characteristics on selection likelihood directly, a conditional logit model (CLM) does allow us to identify changes in their effects over time while dropping any individuals exhibiting no variation across CCs. By drawing on variations in the removal of outgoing CC members and the recruitment of new members, we therefore are able to estimate the changes in competence's effects on CC member selection across CCs. Specifically, we first assume that CC membership status ($y_{it}$)—whether an individual is selected ($y_{it} = 1$) or not ($y_{it} = 0$)—is determined by a set of time-invariant variables that includes competence level ($X_i$) and other controls ($W_i$). We assume further that the effects of the time-invariant variables on the likelihood of CC member selection vary across CCs (denoted by $t$):

$$P(y_{it} = 1) = \frac{e^{X_i\alpha_t + W_i\beta_t}}{1 + e^{X_i\alpha_t + W_i\beta_t}}. \tag{2}$$

We then examine whether the effect of competence changes with the launch of the CR by applying CLM analysis to panel data for the 1958–1982 period:

$$\ln \frac{P_t \big/ (1 - P_t)}{P_{1958} \big/ (1 - P_{1958})} = X_i(\alpha_t - \alpha_{1958}) + W_i(\beta_t - \beta_{1958}) = X_i\gamma_t + W_i\rho_t, \tag{3}$$

[15] "Appendix 7" provides the descriptive statistics on these individual characteristics for each CC.

**Table 2** Conditional logit analysis: changes in competence's effect on selection likelihood

| | Competence measured by education and military rank (in percentile) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Education * Ninth CC (1969) | −0.135*** | −0.165*** | −0.077** | −0.145*** | −0.074** | −0.069** |
| | (0.023) | (0.026) | (0.032) | (0.025) | (0.033) | (0.034) |
| Education * Tenth CC (1973) | −0.133*** | −0.157*** | −0.055* | −0.134*** | −0.052 | −0.047 |
| | (0.023) | (0.026) | (0.032) | (0.025) | (0.033) | (0.034) |
| Education * Eleventh CC (1977) | −0.110*** | −0.131*** | −0.028 | −0.108*** | −0.025 | −0.021 |
| | (0.023) | (0.026) | (0.033) | (0.025) | (0.033) | (0.034) |
| Education * Twelfth CC (1982) | 0.004 | 0.002 | 0.159*** | 0.032 | 0.163*** | 0.165*** |
| | (0.027) | (0.030) | (0.041) | (0.029) | (0.042) | (0.043) |
| Military * Ninth CC (1969) | | 7.390*** | 7.131*** | 7.845*** | 6.963*** | 7.023*** |
| | | (1.138) | (1.734) | (1.169) | (1.722) | (1.743) |
| Military * Tenth CC (1973) | | 6.798*** | 6.439*** | 7.416*** | 6.365*** | 6.466*** |
| | | (1.136) | (1.734) | (1.168) | (1.724) | (1.747) |
| Military * Eleventh CC (1977) | | 5.769*** | 5.097*** | 6.353*** | 5.007*** | 4.999*** |
| | | (1.140) | (1.738) | (1.171) | (1.728) | (1.750) |
| Military * Twelfth CC (1982) | | 5.265*** | 4.165** | 6.027*** | 4.147** | 4.304** |
| | | (1.141) | (1.745) | (1.175) | (1.736) | (1.762) |
| Military Rank * Ninth CC (1969) | | −0.074*** | −0.061*** | −0.076*** | −0.060*** | −0.063*** |
| | | (0.013) | (0.019) | (0.013) | (0.019) | (0.020) |
| Military Rank * Tenth CC (1973) | | −0.080*** | −0.065*** | −0.082*** | −0.064*** | −0.066*** |
| | | (0.013) | (0.019) | (0.013) | (0.019) | (0.020) |
| Military Rank * Eleventh CC (1977) | | −0.067*** | −0.051*** | −0.068*** | −0.050** | −0.050** |
| | | (0.013) | (0.019) | (0.013) | (0.019) | (0.020) |
| Military Rank * Twelfth CC (1982) | | −0.083*** | −0.054*** | −0.085*** | −0.053*** | −0.053*** |
| | | (0.013) | (0.020) | (0.014) | (0.020) | (0.020) |

**Table 2** (continued)

| | Competence measured by education and military rank (in percentile) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Tie with Liu * Ninth CC (1969) | | | | −1.630*** | −0.708 | −1.161* |
| | | | | (0.384) | (0.512) | (0.627) |
| Tie with Liu * Tenth CC (1973) | | | | −1.821*** | −0.619 | −0.822 |
| | | | | (0.374) | (0.508) | (0.632) |
| Tie with Liu * Eleventh CC (1977) | | | | −1.584*** | −0.382 | −0.427 |
| | | | | (0.357) | (0.502) | (0.616) |
| Tie with Liu * Twelfth CC (1982) | | | | −2.169*** | −0.800 | −0.856 |
| | | | | (0.362) | (0.526) | (0.643) |
| Tie with Deng * Ninth CC (1969) | | | | −0.463 | 0.272 | 0.547 |
| | | | | (0.394) | (0.526) | (0.697) |
| Tie with Deng * Tenth CC (1973) | | | | −0.559 | 0.345 | 0.287 |
| | | | | (0.383) | (0.521) | (0.697) |
| Tie with Deng * Eleventh CC (1977) | | | | −0.726* | 0.114 | −0.061 |
| | | | | (0.381) | (0.524) | (0.697) |
| Tie with Deng * Twelfth CC (1982) | | | | −0.969** | 0.029 | 0.236 |
| | | | | (0.387) | (0.540) | (0.740) |
| Tie with Lin * Ninth CC (1969) | | | | −0.591* | 0.233 | 0.506 |
| | | | | (0.332) | (0.455) | (0.666) |
| Tie with Lin * Tenth CC (1973) | | | | −1.188*** | −0.250 | 0.481 |
| | | | | (0.333) | (0.458) | (0.666) |
| Tie with Lin * Eleventh CC (1977) | | | | −1.116*** | −0.253 | 0.171 |
| | | | | (0.325) | (0.454) | (0.659) |
| Tie with Lin * Twelfth CC (1982) | | | | −1.588*** | −0.379 | −0.096 |
| | | | | (0.332) | (0.474) | (0.690) |

**Table 2** (continued)

| | Competence measured by education and military rank (in percentile) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Year dummies | Y | Y | Y | Y | Y | Y |
| Personal characteristics * Year dummies | | | Y | | Y | Y |
| Work experiences * Year | | | | | | Y |
| Number of observations | 4140 | 4045 | 4045 | 4045 | 4045 | 4045 |
| Number of individuals | 828 | 809 | 809 | 809 | 809 | 809 |
| LR-$\chi 2$ | 276.9 | 475.5 | 1151.9 | 545.4 | 1160.3 | 1217.1 |

Coefficients are reported with robust standard errors in parentheses; personal characteristics include birth year, gender, year of joining the CCP and the Long March experience; *significant at 10%; **significant at 5%; ***significant at 1%

where $t = 1969$, 1973, 1977, or 1982 as the year of selection to CC membership, with 1958 (the year of Eighth CC formation) as our reference, and $\gamma_t$ measures the changes in competence's effect ($X_i$) on the log-odds of an individual being selected to join the CC.

We report the baseline results in Table 2, in which we measure an individual's competence by his or her percentile rank in the birth cohort and interact it with year dummies for CC formation (columns 1–3). As column (1) shows, compared to its effect on selection likelihood for the pre-CR Eighth CC, the effect of educational competence on selection likelihood for the first CR period Ninth CC declines significantly. In column (2), to differentiate between the selection of military officers and civilians, we enter a set of interactions between a military status dummy and the year dummies, continuing to use the military rank percentiles to measure the competence of the military officers. Not only do the changes in educational competence's effect on selection likelihood remain similar, but the effect of the military rank percentile also declines significantly from the Eighth to the Ninth CC. The results remain robust when we control for the interactions between the year dummies and such additional variables as birth year, the year of joining the CCP, and dummies for gender and Long March experience (see column 3). Nevertheless, as one final robustness check, we repeat our previous regressions using the absolute measures of competence: years of schooling and military rank. As columns (1)–(3) in "Appendix 8" show, the results remain robust, suggesting that competence's effect on selection likelihood declines significantly from the pre-CR Eighth CC to the first CR period Ninth CC.

### 4.2 Alternative explanation 1: ideological change

Given that purged CC members with more competence (especially education) may have had an ideology that differed from Mao's, such differences might present an alternative explanation for declining CC member competence after inception of the CR. To rule out that competing explanation, we derive testable auxiliary predictions based on Mao's decision to launch the CR. In fact, Mao's proclaimed motive for the CR—"to criticize and repudiate those representatives of the bourgeoisie who have sneaked into the party, the government, the army and all spheres of culture" (Pepper 1991, p. 541)—assumed that most of those educated before 1949, when China was open to capitalism and under KMT rule, had absorbed "bourgeois ideas" and thus were "struggle objects". Disparagement of education, which led many of those with higher education to be persecuted viciously and even tortured to death,[16] may have also contributed to the decline in CC members' competence (as measured by education level) during the CR.

It also should be noted that the ideological change hypothesis does not hold for military CC members. For instance, given the absence of any disapproval of military skills during the CR, the hypothesis cannot explain the declining competence of military members in the first CR period as measured by their military ranks based on prior battle achievements. The most convincing explanation is that because China's external environment after the first CR period generally was stable and peaceful, despite some minor conflicts with the Soviet Union in 1969 and with Vietnam in 1979. The payoff to military competence declines and, hence, capable military officers were less likely to be selected.

[16] For more details, see Bastid (1970), Schram (1989) and Pepper (1991).

### 4.3 Alternative explanation 2: power struggle

Another alternative explanation, the power-struggle hypothesis, would predict that when Mao, in the first CR period, evicted Liu Shaoqi and Deng Xiaoping as key first-front leaders in charge of day-to-day affairs by appointing Lin Biao as sole CCP Deputy Chairman and his new successor, he would then purge all CC members from Liu or Deng's factions and replace them with followers of Lin. If the purged factions were more competent than Lin's faction, it would confound our finding of a declining competence effect on selection likelihood during the first CR period. For example, a military officer connected with Liu or Deng might be more likely to have been granted a higher military rank in 1955, but more likely to be purged after CR inception.

To rule out that possibility, we enter into our CLM analysis three individual-specific dummies for factional ties with Liu Shaoqi, Deng Xiaoping and Lin Biao, respectively. Unlike previously used measures that rely on leader–follower coincidences—for example, being born in the same province, being educated at the same institution, or having worked together (Shih et al. 2012)—our measure is based on shared work experience. Our rationale for that choice is as follows: Factional ties from the 1950s to the 1980s mainly were developed during the 1936–1949 period in separate revolutionary base areas developed by regional leaders to whom Mao had entrusted power (Huang 2000). Given the large degree of independence in decision making, the regional leaders, including Liu, Deng and Lin, were able to make first-hand acquaintances with their followers. Because the base areas at that time were isolated and the personal bonds nurtured by the perils of war, the resulting factional ties relied strongly on shared work experiences and should thus be more easily identifiable and more stable than those formed after 1949.

As Table 2, column (5) shows, similar results hold when the factional ties in interaction with the year dummies are added to the regression. The effect of civilian education first declines significantly between the pre-CR Eighth CC and first CR period Ninth CC by 0.074 percentile points, and then increases gradually since the second CR period Tenth CC. For military officers, however, a significant weakening in the effect of competence (as measured by military rank) occurs only between the Eighth and the Ninth CC (−0.060; column 5). While a significant decline during the same period is observable for the effect of factional ties to Liu Shaoqi (−1.630; column 4), statistical significance disappears when the specification includes personal characteristics (column 5).

We do recognize, however, that controlling only for the three types of factional ties may be inadequate, so we next construct nine dummies representing CC member work experience during the three main periods preceding the founding of the PRC.[17] First, for the first KMT-CCP civil war of 1927–1936, we construct two dummies indicating whether the members had worked at Jiangxi Revolutionary Base (the cradle of the Red Army) or at other base areas in southern China, respectively. Second, for the Sino-Japanese War of 1937–1945, we generate three dummies indicating whether members had worked at the Shaan-Gan-Ning Revolutionary base directly under Mao, at the Northern Bureau, or in the Communist Eighth Route Army, respectively. Finally, for the second KMT-CCP civil war of 1946–1949, we build four dummies indicating whether the members had worked at the Northeast Revolutionary base, at the Northern Bureau, in the Second Field Army, or in the Fourth Field Army, respectively. As Table 2, column (6) shows, even after we control for

[17] The observations on each CC member's work experience, compiled by Shih et al. (2010), were downloaded from http://bit.ly/2jEAy6L.

these nine dummies (interacted with year dummies), the results remain robust, confirming that the changing patterns in competence's effect during the period from the pre-CR Eighth to the post-CR Twelfth CC are not confounded by factional struggles.

## 5 Understanding the mechanisms

As discussed previously, the various theoretical models capable of explaining our empirical findings assume different mechanisms. For example, according to Glazer's (2002) model, which considers the costs and benefits of subordinate competence, a dictator must balance the competence effect on external rent seeking (producing benefits for the organization) with that on internal rent seeking (sharing power and benefits within the organization). In the Chinese context, because establishing the new regime caused the latter to outweigh the former, the optimal choice for Mao was to reduce subordinate competence. Egorov and Sonin's (2011) contract theory model similarly suggests that when a dictator's power evaluation increases the cost of subordinate betrayal, the dictator tends to sacrifice competence by hiring mediocre agents. Within that paradigm, establishing the new regime increases the value of the dictator's stakes, leading Mao to have less tolerance for betrayal and purge the competent incumbents. An auxiliary prediction of this literature is that given the same level of competence, CC members whose punishment comes at little cost (e.g., the more educated incumbents with strong ties to the Liu faction) are more likely to be purged. The Zakharov (2016) model, in contrast, focuses on subordinates' outside options, availability of which is likely to reduce their loyalty levels. As we mentioned in the introduction, that logic implies the auxiliary prediction that younger competent members will be more likely to be purged than their older counterparts.

To test these auxiliary predictions from competing mechanisms, we focus on which types of pre-CR period CC members were more likely to be purged during the early CR period. To do so, we apply a logit model that estimates the effects of the interaction terms between education, age and factional ties based on the following specification:

$$P(Purge_i = 1) = \frac{e^{X_i\alpha + W_i\beta}}{1 + e^{X_i\alpha + W_i\beta}}, \tag{4}$$

where $Purge_i = 1$ if the pre-CR CC members did not serve in the April 1969 CC (the CCP Ninth Congress). In our initial analysis, we include only the independent variables listed in Table 2, the results for which indicate that education and birth year have significantly positive effects on purge probabilities (column 1). On the one hand, the positive education effect reconfirms the role of the loyalty–competence tradeoff in the CR-period replacement of CC members, with those having a 10 percentile point higher education level subject to a 13.4% point increase in purge probability (Table 3, column 1). On the other hand, the fact that younger individuals appear more likely than older CC members to be removed supports Zakharov's (2016) prediction that younger members with hopes of better future alternatives place less value on their current positions and thus invest less in loyalty.

To test the predictions of these two mechanisms further, we next interact education with birth year and factional ties. Although we find additional support for Zakharov's (2016) younger member prediction in the form of a significantly positive interaction term between education and birth year (Table 3, column 2), we find no strong evidence for Glazer's (2002) and Egorov and Sonin's (2011) prediction of a greater purge probability among CC members with ties to the Liu faction. That is, although the interaction between education

**Table 3** The effect of competence on the probability of being purged during 1966–1969

| Dependent variable | Purged (dummy): logit | | | | | Political ranks in 1969: ordered probit | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Education percentile (×0.1) | 0.713* | 0.775* | 0.730* | 0.713* | 0.732** | −0.372** | −0.266** |
| | (0.378) | (0.439) | (0.423) | (0.403) | (0.352) | (0.173) | (0.133) |
| | *0.136*$^{+}$ | *0.147*$^{+}$ | *0.134*$^{+}$ | *0.128*$^{+}$ | *0.130*$^{++}$ | *0.121*$^{++}$ | *0.083*$^{++}$ |
| Education * Birth year (×0.1) | | 0.172** | 0.158** | 0.140** | 0.146** | | −0.090*** |
| | | (0.070) | (0.067) | (0.062) | (0.064) | | (0.030) |
| | | *0.033*$^{+++}$ | *0.029*$^{++}$ | *0.025*$^{++}$ | *0.026*$^{++}$ | | *0.028*$^{+++}$ |
| Birth year * Liu (×0.1) | | | 1.672* | 0.390 | 0.244 | | 0.294 |
| | | | (0.869) | (0.913) | (0.878) | | (0.493) |
| | | | *0.306*$^{++}$ | *0.074* | *0.047* | | *−0.089* |
| Education * Birth year * Liu (×0.1) | | | | 0.931** | 0.961** | | −0.517** |
| | | | | (0.424) | (0.437) | | (0.240) |
| | | | | *0.168*$^{++}$ | *0.171*$^{++}$ | | *0.162*$^{++}$ |
| Education * Liu(×0.1) | | 0.146 | 0.952 | −0.921 | −0.905 | | 1.303 |
| | | (0.742) | (0.940) | (3.133) | (3.409) | | (0.811) |
| | | *0.028* | *0.174* | *−0.166* | *−0.161* | | *−0.409* |
| Birth year (×0.1) | 0.868** | 0.773** | 0.539 | 0.529 | 0.332 | −0.548*** | −0.240 |
| | (0.384) | (0.373) | (0.379) | (0.376) | (0.438) | (0.196) | (0.228) |
| | *0.166*$^{++}$ | *0.146*$^{++}$ | *0.099* | *0.095* | *0.059* | *0.178*$^{+++}$ | *0.075* |
| Liu (targeted faction) | 0.532 | 0.607 | 0.869 | 1.501** | 1.631** | −0.327 | −0.923*** |
| | (0.419) | (0.426) | (0.552) | (0.691) | (0.685) | (0.238) | (0.317) |
| | *0.101* | *0.115* | *0.159* | *0.271*$^{++}$ | *0.290*$^{++}$ | *0.106* | *0.289*$^{+++}$ |
| Baseline controls | Y | Y | Y | Y | Y | Y | Y |
| Ranks in the CC committee | | | | | Y | Y | Y |
| LR | | | | | | | |
| Observations | 190 | 190 | 190 | 190 | 190 | 190 | 190 |

Coefficients are reported with robust standard errors in parentheses. Marginal effects are italicized. For the ordered probit model, we report the marginal effect on the probability of being purged in order to compare with the Logit model. Baseline controls include gender, year of joining the CCP, the Long March experience, military status and factional ties with Deng and Lin. *significant at 10%; **significant at 5%; ***significant at 1%. + significant at 10%; ++ significant at 5%; +++ significant at 1%

and factional ties is positively related to being purged, the association is not significant. On the other hand, when we test the mechanisms of the outside option model by interacting factional ties with birth year (Table 3, column 3), we find that the younger CC members tied to Liu's faction are indeed more likely to be removed. When we then include a triple interaction term between education, birth year and Liu faction, it turns out to be significantly positive, which is consistent with the outside option mechanism. This latter result suggests that if CC members with more outside options (e.g., those who are younger and more educated) happen to belong to a targeted faction, the dicator's cost of removing them is lower.

We test the robustness of our findings by applying different econometric models and including more controls. For example, instead of the CLM used in Sect. 4 to estimate the change in education effect, we use cross-individual variations to assess how education

affects the likelihood of being purged, a test that necessitates the additional inclusion of pre-CR political ranks. Although the purge involved all four of the ranks displayed in Fig. 2, the magnitude of each might be different. We therefore include the member's initial political rank, measured by one of three dummies: full member, Politburo member, or Politburo Standing Committee member. The results (Table 3, column 5) indicate that our findings remain very stable.

Another necessary robustness check is determining whether our findings are sensitive to the definition of "being purged", especially as Fig. 2 indicates that some members may have remained in the CC, but demoted to lower ranks. We exploit that variation by using political rank in 1969 as an alternative dependent variable while controlling for political rank in 1958. Given the properties of the dependent variable, we employ an ordered probit model and replicate the results in Table 3, columns (1) and (5). Because we are interested in the explanatory variables' marginal effects on purge probability rather than the coefficient values per se, we transform the latter and report the marginal effect of $X$ on CC purge probability. A comparison with the probit model results (Table 3, columns 6 and 7) shows them to be quite similar to those from the logit model (columns 1 and 5).

Overall, our findings strongly support the predictions and mechanism of Zakharov's (2016) subordinate outside option model as they relate to the loyalty–competence tradeoff. The analytical results suggest not only that during China's CR period, younger educated CC members were more likely than older educated incumbents to be purged, but that if they also had strong ties to the targeted Liu faction, the relatively lower cost of removing them raised their purge probability.

## 6 Conclusions

Much anecdotal evidence suggests that whereas competent subordinates can help a dictator obtain economic rents and carry out political repression more effectively, they also are more prone to treason. Yet the many theoretical studies examining that issue offer no systematic evidence on it. To fill the research gap, this study uses a biographical dataset of Chinese Communist Party Central Committee (CC) members empirically to investigate the dictator's loyalty–competence tradeoff by focusing on CC member selection during the 1945–1982 period, which covers Mao Zedong's 1966–1976 Cultural Revolution (CR).

The loyalty–competence tradeoff hypothesis predicts that a reduction in competence's payoff will prompt the dictator to replace competent subordinates with mediocre substitutes. In the case of China, Mao initially needed competent people to help him fight the Kuomintang (KMT), consolidate the new regime, and revive the economy. Once those tasks were completed, however, Mao launched the CR to purge competent officials and recruit mediocre replacements. According to our birth cohort analysis, which measures competence using both education and military rank percentiles, the average competence of CC members declined significantly from the pre-CR Eighth CC to the first CR period Ninth CC. The conditional logit analysis also shows that competence's effect on CC selection likelihood fell significantly with the onset of the CR.

Although such declining competence hypothetically could be explained by either the ideological change or power struggle hypotheses, we rule out the first by highlighting a reduction in the effect of military skill on the probability of being selected. We then eliminate the second hypothesis by entering three dummies for factional ties into the regression and demonstrating the power struggle alternative's inability to explain

the changes in competence's effects. Therefore, all of our results provide clear evidence for the dictator's loyalty–competence tradeoff hypothesis, which captures Mao's growing concern about both the social order and the nation's economy, which the Cultural Revolution had left in tatters.

We test the competing mechanisms of the loyalty–competence tradeoff further by examining their different predictions. Our results show that the interaction between birth year and education have a significantly positive effect on the purge probability, and the younger educated CC members belonging to the Liu faction were indeed more likely to be removed. Our evidence provides strong support for the subordinate outside option model (Zakharov 2016), which predicts that younger competent members should be more likely to be purged than their older counterparts because they have more outside options, such as being more likely to be recruited by a successor, and thus invest less effort in loyalty.

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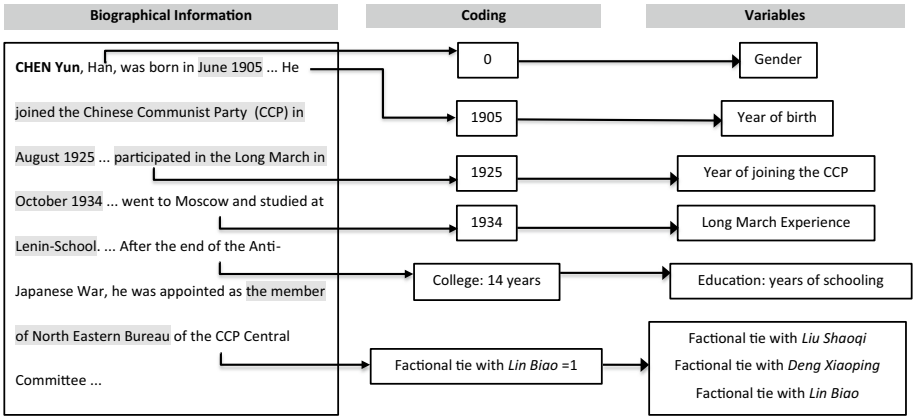
## Appendix 1: Dataset construction

We collect the biographical data on each CC member serving in 1945–82 from the *Dictionary of Past and Present CCP Central Committee Members 1921–2003* (*Zhongguo gongchandang lijie zhongyang weiyuan da cidian*) published in 2003 by the Central Organization Department and Party History Research Center of the CCP CC. We illustrate the construction of our individual-level dataset below:



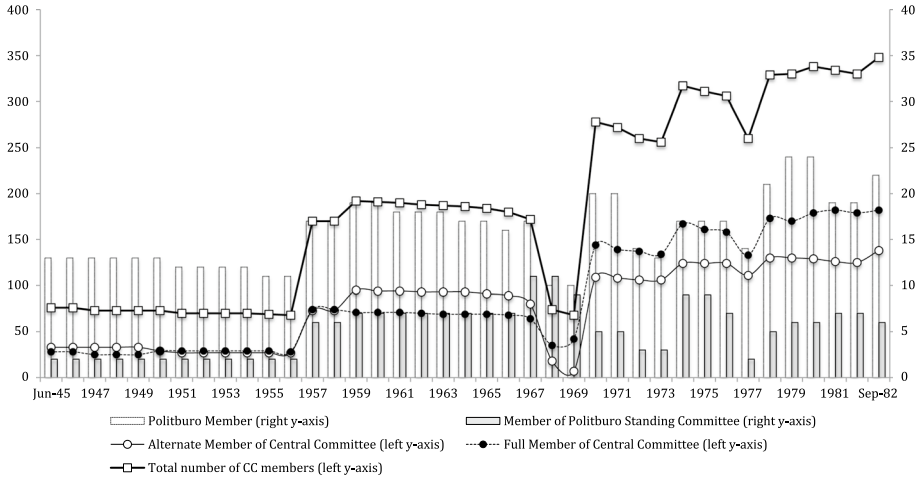



**Fig. 5** Annual changes in the size of the CC, June 1945–September 1982. *Source*: *The Dictionary of Past and Present CCP Central Committee Members*

## Appendix 2: Changes in CC size, 1945–1982

To illustrate the overall replacement patterns, we summarize and plot the changes in CC membership size from 1945 to 1982. As Fig. 5 shows, before the CR, CC membership more than doubled from 76 members in 1945 to 180 in 1966. No significant replacement occurred until the launch of the CR, after which the size of the CC changed frequently, characterized by large-scale removals of old members and the mass promotion of new members. These mass replacements did not stop the CC from expanding, however, and its membership doubled again in 1982 to 348. These trends remain similar even after we divide CC members into four groups based on status or rank, which are, from top to bottom, Politburo Standing Committee member, Politburo member, full member, and alternate member.

## Appendix 3: Relative competence of CC members across birth cohorts, by CC

Figure 6a shows the average years of schooling across birth cohorts for three groups: the population, members of the pre-CR Eighth CC, and members of the first CR period Ninth CC. The gap between the CC members and the population in the same cohort suggests the former's relative competence. Thus, given the gradual increase in the national average education, it further suggests a decrease in competence from the Eighth CC to the Ninth CC, especially among cohorts younger than that of 1895–1899.[18]

[18] Mao was born in 1893 and therefore belonged to the 1890–1894 cohort.

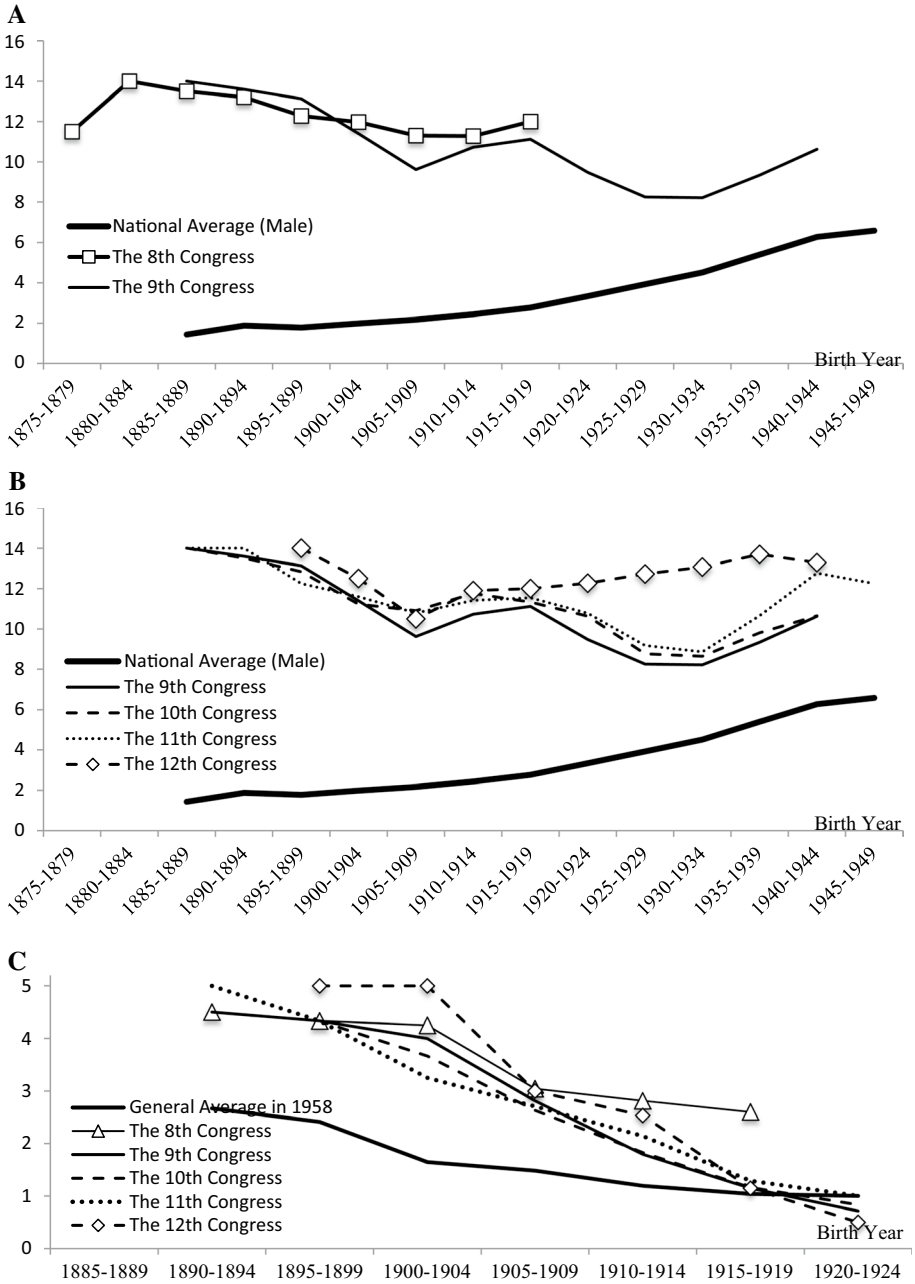



**Fig. 6** **a** Average years of schooling: eighth and ninth CCs. **b** Average years of schooling: ninth to twelfth CC. **c** average military ranks. *Sources*: (1) *The Dictionary of Past and Present CCP Central Committee Members*. (2) China's 1982 census data; (3) *Who's Who of General Officers of the People's Liberation Army*

We also compare the national average years of schooling with that of CC members during and after the CR. As Fig. 6b shows, the members of the Ninth CC selected in the first

CR period generally had the lowest average level of education. The second-lowest level was that of the members of the Tenth CC selected in the second CR period. Although the members of the post-CR Eleventh CC had a similar average education to that of the members of the Tenth CC, its younger cohorts were obviously more highly educated. The highest average education level was for members of the Twelfth CC. all of which supports the finding that CC members' average education decreased in the first CR period and gradually increased afterwards.

Figure 6c shows the average military ranks across birth cohorts for six groups: the population and five sets of CC members. Similar to the changes in CC members' average education, the average military rank declined from the pre-CR Eighth CC to the first CR period Ninth CC, with the average military rank of the 1920–1924 cohort in the Ninth CC being even lower than the overall average. After the second CR period, however, the average military ranks show no significant changes across CCs.

## Appendix 4: Annual changes in CC members' average competence

Figure 7a shows the annual changes in CC members' average years of schooling, a value that decreases sharply during the first CR period. Specifically, the CC members selected in 1966, when the CR began, averaged around 11.63 years of schooling (almost the level of senior high school). The value bottomed out in 1969, when the Ninth NPC was convened, at about 10.31 years (between middle and high school). It increased to 10.69 years by 1973 in the second CR period and to 11.03 years by 1977 after the CR. By 1982, the average had reached about 12.31 years (senior high school), a return to the pre-CR level. When looking exclusively at the changes in the average years of schooling of civilian CC members, we find a larger range of change but similar general patterns.

Figure 7b shows the annual changes in the average military rank of CC military members. Like educational averages, the average military rank also declined sharply in the first CR period, from about 3.286 (higher than general) before the CR to 1.855 (lower than lieutenant general) in 1969. After that, no significant changes are observable.

## Appendix 5: Average education percentiles: civilian versus military

Given that education levels are more strongly related to the quality and performance of civilian officials, we repeat the previous exercises exclusively for civilian CC members. As Fig. 8a shows, the patterns are not only very similar to those for all CC members but are even more salient, with average education percentiles decreasing to as low as around the 70th percentile for the first CR period Ninth CC. Although the average percentiles of military CC members also decreased significantly for the Ninth CC, no obvious changes occurred afterwards (see Fig. 8b).

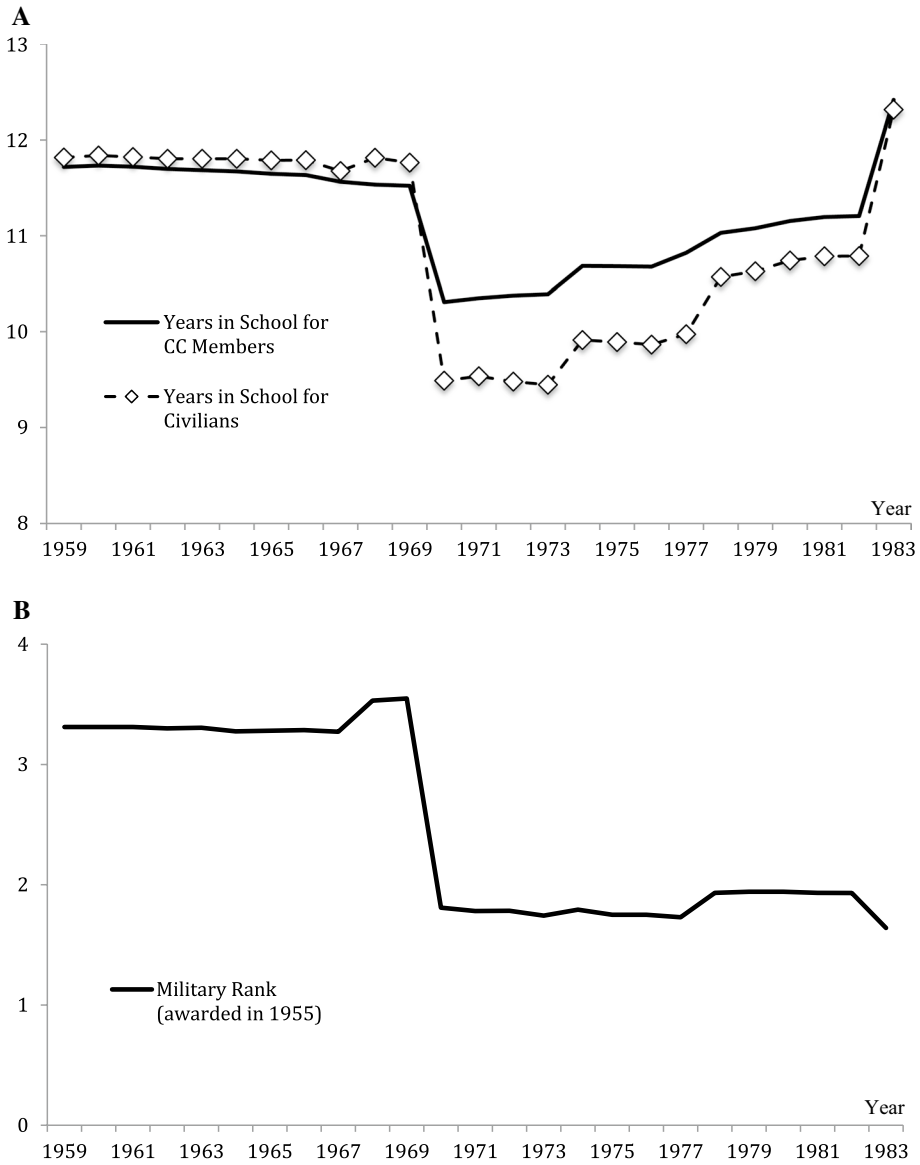



**Fig. 7** **a** CC members' average years of schooling, January 1, 1959–January 1, 1983. **b** Average military rank granted in 1955, January 1, 1959–January 1, 1983. *Source*: *The Dictionary of Past and Present CCP Central Committee Members*

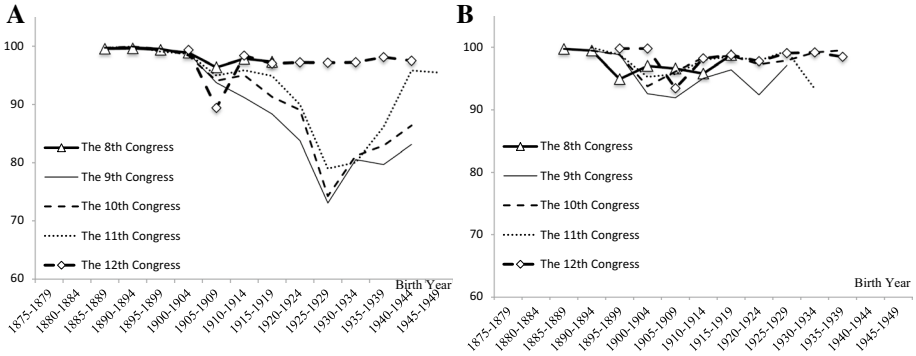



**Fig. 8** **a** Civilian CC members. **b** Military CC members. *Sources*: *The Dictionary of Past and Present CCP Central Committee Members* and 1982 China census data

## Appendix 6: Birth cohort analysis: changes in years of schooling or military rank across CCs

| Dependent variable | Average education All CC members | | Average education All civilians | | Average education All military officers | | Average rank All military officers | |
|---|---|---|---|---|---|---|---|---|
| | (1.1) | (1.2) | (2.1) | (2.2) | (3.1) | (3.2) | (4.1) | (4.2) |
| | RE | FE | RE | FE | RE | FE | RE | FE |
| Ninth CC (1969) | −1.079*** | −0.874** | −1.238*** | −0.993*** | −0.700 | −0.797* | −0.530*** | −0.475** |
| | (0.355) | (0.336) | (0.359) | (0.292) | (0.450) | (0.424) | (0.203) | (0.207) |
| Tenth CC (1973) | −0.651** | −0.406 | −1.135*** | −0.810*** | 0.228 | 0.124 | −0.567*** | −0.493** |
| | (0.305) | (0.291) | (0.308) | (0.238) | (0.363) | (0.372) | (0.146) | (0.157) |
| Eleventh CC (1977) | −0.215 | 0.049 | −0.404 | −0.055 | 0.081 | −0.046 | −0.590*** | −0.535*** |
| | (0.255) | (0.267) | (0.262) | (0.265) | (0.349) | (0.352) | (0.160) | (0.166) |
| Twelfth CC (1982) | 1.219*** | 1.568** | 1.353*** | 1.866** | 0.469 | 0.276 | −0.329 | −0.268 |
| | (0.431) | (0.593) | (0.435) | (0.666) | (0.313) | (0.314) | (0.238) | (0.231) |
| Constant | 11.592*** | 11.273*** | 11.497*** | 11.056*** | 11.858*** | 12.021*** | 2.577*** | 2.691*** |
| | (0.243) | (0.247) | (0.275) | (0.224) | (0.302) | (0.276) | (0.472) | (0.143) |
| Number of observations | 232 | 232 | 217 | 217 | 144 | 144 | 135 | 135 |
| Number of birth years | 61 | 61 | 61 | 61 | 42 | 42 | 38 | 38 |
| R-squared (within) | 0.33 | 0.33 | 0.35 | 0.35 | 0.11 | 0.11 | 0.22 | 0.22 |

Coefficients are reported, with robust standard errors in parentheses clustered by 5-year cohort; *, **, and ***denote significance at the 10%, 5%, and 1% levels, respectively

## Appendix 7: Individual-level data: descriptive statistics

| | Eighth CC (1) | Ninth CC (2) | Tenth CC (3) | Eleventh CC (4) | Twelfth CC (5) |
|---|---|---|---|---|---|
| Total number of CC members | 193 | 279 | 319 | 332 | 348 |
| Education (years of schooling) | 11.689 | 10.323 | 10.675 | 11.033 | 12.415 |
| | (2.567) | (3.327) | (3.160) | (2.980) | (2.169) |
| Percentile of education | 97.429 | 90.312 | 90.722 | 92.852 | 97.455 |
| | (5.216) | (14.517) | (14.248) | (12.383) | (4.121) |
| Military ranks | 3.311 | 1.812 | 1.787 | 1.916 | 1.641 |
| | (0.992) | (1.219) | (1.268) | (1.150) | (1.264) |
| Percentile of military ranks | 90.604 | 65.793 | 62.438 | 70.099 | 60.809 |
| | (13.942) | (30.916) | (32.047) | (29.534) | (34.331) |
| Military officers (dummy) | 0.316 | 0.470 | 0.339 | 0.325 | 0.230 |
| | (0.466) | (0.500) | (0.474) | (0.469) | (0.421) |
| Gender (female = 1) | 0.041 | 0.082 | 0.129 | 0.114 | 0.069 |
| | (0.200) | (0.276) | (0.335) | (0.319) | (0.254) |
| Birth year | 1905 | 1917 | 1921 | 1920 | 1922 |
| | (7.027) | (11.778) | (12.902) | (11.936) | (8.000) |
| Year of joining the CCP | 1928 | 1939 | 1943 | 1942 | 1942 |
| | (3.697) | (12.347) | (13.654) | (13.218) | (9.448) |
| Long March experience (dummy) | 0.497 | 0.416 | 0.313 | 0.337 | 0.155 |
| | (0.501) | (0.494) | (0.465) | (0.474) | (0.363) |
| Tie with Liu Shaoqi (dummy) | 0.238 | 0.097 | 0.085 | 0.102 | 0.089 |
| | (0.427) | (0.296) | (0.279) | (0.304) | (0.285) |
| Tie with Deng Xiaoping (dummy) | 0.166 | 0.136 | 0.119 | 0.111 | 0.092 |
| | (0.373) | (0.344) | (0.324) | (0.315) | (0.289) |
| Tie with Lin Biao (dummy) | 0.280 | 0.272 | 0.182 | 0.193 | 0.147 |
| | (0.450) | (0.446) | (0.386) | (0.395) | (0.354) |

Sample means are reported, with standard deviations in parentheses

## Appendix 8: Conditional logit analysis: changes in competence's effect on selection likelihood

| | Competence measured by education and military rank (in absolute value) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Education * Ninth CC (1969) | −0.231*** | −0.350*** | −0.310*** | −0.325*** | −0.302*** | −0.274*** |
| | (0.040) | (0.045) | (0.076) | (0.048) | (0.076) | (0.081) |
| Education * Tenth CC (1973) | −0.178*** | −0.266*** | −0.202*** | −0.238*** | −0.194** | −0.163** |
| | (0.039) | (0.044) | (0.075) | (0.046) | (0.076) | (0.080) |
| Education * Eleventh CC (1977) | −0.115*** | −0.192*** | −0.128* | −0.164*** | −0.120 | −0.092 |
| | (0.039) | (0.043) | (0.075) | (0.046) | (0.076) | (0.080) |

| | Competence measured by education and military rank (in absolute value) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Education * Twelfth CC (1982) | 0.178*** | 0.131*** | 0.228*** | 0.162*** | 0.238*** | 0.272*** |
| | (0.042) | (0.046) | (0.079) | (0.049) | (0.080) | (0.084) |
| Military * Ninth CC (1969) | | 8.373*** | 7.580*** | 9.208*** | 7.361*** | 7.134*** |
| | | (1.115) | (1.307) | (1.151) | (1.295) | (1.331) |
| Military * Tenth CC (1973) | | 7.445*** | 6.572*** | 8.474*** | 6.455*** | 6.301*** |
| | | (1.114) | (1.306) | (1.151) | (1.294) | (1.333) |
| Military * Eleventh CC (1977) | | 6.931*** | 5.594*** | 7.880*** | 5.467*** | 5.193*** |
| | | (1.113) | (1.306) | (1.149) | (1.294) | (1.332) |
| Military * Twelfth CC (1982) | | 6.103*** | 4.383*** | 7.160*** | 4.321*** | 4.212*** |
| | | (1.123) | (1.318) | (1.157) | (1.307) | (1.349) |
| Military Rank * Ninth CC (1969) | | −3.090*** | −2.374*** | −3.238*** | −2.330*** | −2.334*** |
| | | (0.448) | (0.514) | (0.458) | (0.518) | (0.541) |
| Military Rank * Tenth CC (1973) | | −3.164*** | − 2.301*** | −3.304*** | −2.270*** | −2.250*** |
| | | (0.450) | (0.514) | (0.460) | (0.518) | (0.542) |
| Military Rank * Eleventh CC (1977) | | −2.950*** | −2.078*** | −3.091*** | −2.044*** | −1.985*** |
| | | (0.449) | (0.515) | (0.459) | (0.519) | (0.542) |
| Military Rank * Twelfth CC (1982) | | −3.384*** | −2.104*** | −3.526*** | −2.075*** | −2.004*** |
| | | (0.466) | (0.531) | (0.475) | (0.535) | (0.561) |
| Tie with Liu * Ninth CC (1969) | | | | −2.093*** | −0.687 | −1.088* |
| | | | | (0.403) | (0.526) | (0.650) |
| Tie with Liu * Tenth CC (1973) | | | | −2.245*** | −0.589 | −0.712 |
| | | | | (0.389) | (0.521) | (0.651) |
| Tie with Liu * Eleventh CC (1977) | | | | −1.918*** | −0.336 | −0.307 |
| | | | | (0.371) | (0.514) | (0.635) |
| Tie with Liu * Twelfth CC (1982) | | | | −2.226*** | −0.821 | −0.798 |
| | | | | (0.371) | (0.534) | (0.657) |
| Tie with Deng * Ninth CC (1969) | | | | −0.853** | 0.312 | 0.558 |
| | | | | (0.421) | (0.544) | (0.724) |
| Tie with Deng * Tenth CC (1973) | | | | −0.961** | 0.359 | 0.184 |
| | | | | (0.408) | (0.540) | (0.724) |
| Tie with Deng * Eleventh CC (1977) | | | | −1.014** | 0.164 | −0.194 |
| | | | | (0.405) | (0.542) | (0.720) |
| Tie with Deng * Twelfth CC (1982) | | | | −1.098*** | 0.026 | 0.034 |
| | | | | (0.414) | (0.564) | (0.768) |
| Tie with Lin * Ninth CC (1969) | | | | −1.020*** | 0.302 | 0.456 |
| | | | | (0.355) | (0.490) | (0.726) |
| Tie with Lin * Tenth CC (1973) | | | | −1.602*** | −0.162 | 0.456 |
| | | | | (0.353) | (0.490) | (0.723) |
| Tie with Lin * Eleventh CC (1977) | | | | −1.406*** | −0.136 | 0.175 |
| | | | | (0.345) | (0.485) | (0.716) |
| Tie with Lin * Twelfth CC (1982) | | | | −1.732*** | −0.321 | −0.118 |
| | | | | (0.352) | (0.504) | (0.754) |
| Year dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Personal characteristics * Year dummies | | | Yes | | Yes | Yes |

| | Competence measured by education and military rank (in absolute value) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Working experiences * Year | | | | | | Yes |
| Number of observations | 4165 | 4075 | 4075 | 4075 | 4075 | 4075 |
| Number of individuals | 833 | 815 | 815 | 815 | 815 | 815 |
| LR-$\chi 2$ | 241.5 | 500.3 | 1158.3 | 582.2 | 1166.4 | 1223.1 |

Coefficients are reported, with robust standard errors in parentheses; personal characteristics include birth year, gender, year of joining the CCP, and the Long March experience; *significant at 10%; **significant at 5%; ***significant at 1%

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